

# Flame Extinguishment Experiment (FLEX)



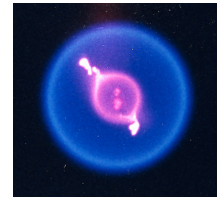
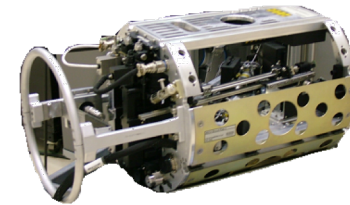
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(Left) The Combustion Integrated Rack. (Top Right) FLEX Chamber Insert Assembly Apparatus. (Bottom Right) Color image of a burning droplet.

## Objective:

- **Modular apparatus designed to study the combustion of single fuel droplets in microgravity; results have applications to spacecraft fire safety and fundamental combustion**
  - Assess and quantify the effectiveness of inert-gas suppressants in microgravity; provides the most conservative estimate of the limiting oxygen index for steady combustion
  - Study the behavior of near-limit diffusion flames, examining in detail liquid- and gas-phase transport and chemical kinetics
  - Develop and validate detailed and reduced-order transport and chemistry models that are the foundation for real engine simulations

## Relevance/Impact:

- **The combustion of liquid fuels is the overwhelming energy source in the transportation sector**
  - Allow the development of rational design rules for fire suppression in exploration vehicles and habitats, based on the unique hazards of space
  - Design future combustors to minimize carbon footprint (maximize fuel efficiency), minimize pollutant emissions and utilize alternative fuel sources (e.g. biofuels)

## Development Approach:

- Flight design leverages off previous flight design heritage (STS-83/94)
- Multi-user, re-usable apparatus minimizing up-mass/volume, costs, and crew involvement

## ISS Resource Requirements

Accommodation (carrier)	Combustion Integrated Rack
<b>Upmass (kg)</b> (w/o packing factor)	254 kg
<b>Volume (m<sup>3</sup>)</b> (w/o packing factor)	0.48 m <sup>3</sup>
<b>Power (kw)</b> (peak)	0.73 Kw
<b>Crew Time (hrs)</b> - Initial configuration of CIR Rack - Change-outs during experiment	8.5 hrs 8.3 hrs
<b>Autonomous Ops (hrs)</b>	300 hrs
<b>Data Points</b>	258 data points FLEX & FLEX-H

## Project Life Cycle Schedule

Milestones	FY95 NRA Process	HCR/RDR	CDR	VRR	Safety (PH-3)	PSR-2	Ship	Launch	Ops	Return	Final Report
Actual/ Baseline	Nov 1998	Aug 2001	July 2003	March 2004	Oct 2005	May 2007	Feb 2008	Nov 2008	Jan 2009	Mar 2011	Mar 2012